ENGINEERS INSIGHT

A·P·U
ASIA PACIFIC UNIVERSITY
OF TECHNOLOGY & INNOVATION

The Institution of Engineers, Malaysia

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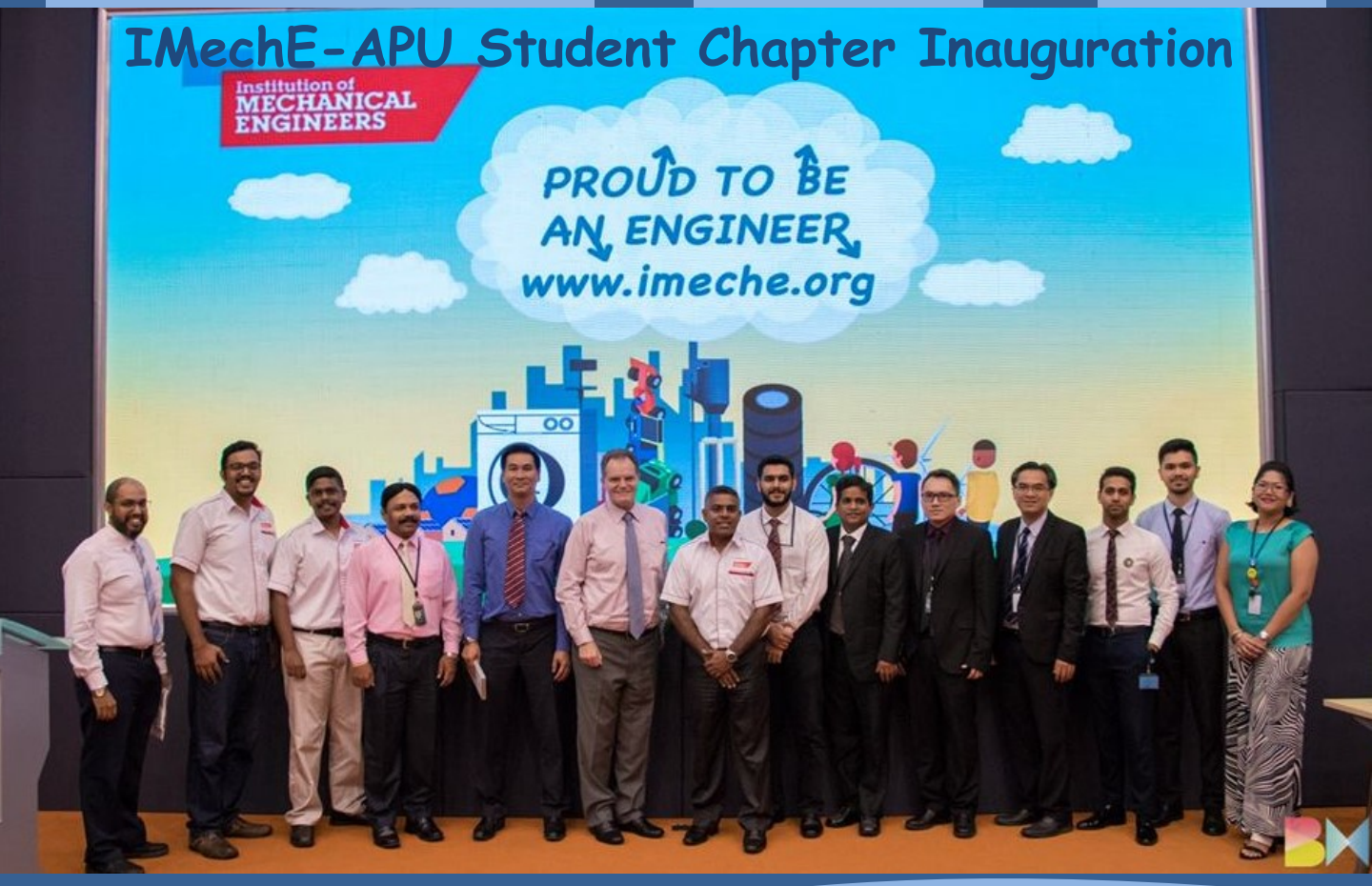
ASIA PACIFIC INSTITUTE
OF INFORMATION TECHNOLOGY

SCHOOL OF ENGINEERING | JUNE 2018 | VOLUME 21



Editorial Team
Dr Shankar Duraikannan
Prof Ir Dr Vinesh Thiruchelvam

If you would like to be a part of the 'Engineers Insight' editorial team or have an article / paper published please contact: shankar@apu.edu.my

Engineers Insight' is a quarterly issue by the School of Engineering for the reading pleasure of the staff and students allowing for knowledge sharing and capturing of events for the benefit of engineering education.

From the Editors Desk

Celebrate Cultural Diversity through Humanity

Cultural diversity is the great gift of nature to explore the capabilities of human and to make the world a comfortable place for every living things. Difference and diversity are the laws of nature. For instance, no two human are identical. Every human have their unique figure print, iris, color, hair etc. Back from the days of creation, the food man ate, the dress man wore from what he got from the nature around the place he was born and lived, became his habit and his culture latter. With expansion of human kind and their knowledge, regulations and laws were created by every nation to preserve the culture of the people for better and safe social life. The desire of human to spread the good things he got from the nature around him and to taste and enjoy the good things from other parts of the world initiated the business and recreational activities across the world, which requires human to move across the landscapes of the world. In this era of information and technology, where people across the world move to look for and to create better opportunities, humans of different ethnic group are required to work together, which requires a good rapport. Appreciating and celebrating the culture of every person around us is the best way to build a good rapport.

The best way of celebrating cultural diversity is to learn, understand, respect and acknowledge the culture of every person we meet in our day to day life. Learning the culture of every people and the law of every country might be harder for every person, therefore the practice of humanity is the easy alternative way to celebrate the cultural difference, as humanity is the foundation of every culture irrespective of their geographical location of origin. The qualities of humanity such as love, peace, kindness, goodness etc. are the foundation every culture, against which there is no law. If we could practice these qualities in our daily life and with every person in every business and recreational transaction, the cultural difference will never be felt as a barrier to build and enrich the relationship with any person across the world.

To conclude in an comic way, we all know that we are moving forward into Internet of Things, the technology that would enable every living and non-living thing to communicate with us. We will be expected to be more matured, understanding and open minded to the machines created across the globe which may reflect the culture of their geographical location and their creators. I still strongly believe that, the qualities of humanity which is the same for eras together in spite of advancements in knowledge and intelligence of mankind will again be the best tool to interact with robots and machines which are created to be more intelligent than man. I conclude my word saying the world lives by humanity and will extinct with extinction of humanity. Let's celebrate humanity that unite people of different culture across ages and generations for the benefit everyone.

Dr Shankar Duraikannan

In this volume

Contributors

Dr Shankar Duraikannan
Ms Shamini Pathmanathan
Mr Lim Chee Chew

If you would like to be a part of the 'Engineers Insight' editorial team or have an article / paper published please contact: shankar@apu.edu.my

INDUSTRY 4.0

Industry 4.0. What is Industry 4.0? Why Industry 4.0 has been actively discussed in both the industry and academic sectors nowadays? Even the Malaysian Education Ministry has embarked on a plan in introducing and implementing curriculum aligned with Industry 4.0 in higher education institutions. Its aim is to better equip students with the current trends and the changes caused by Industry 4.0 and eventually fulfill industrial needs once students graduate. In accordance to this plan, the Malaysian Education Ministry is already preparing to implement the Professional Development Programme 4.0 for lecturers with the aim of having 30 per cent of all teaching and learning at public higher education institutions be aligned to Industry 4.0 by 2020.

Figure 1: Industry 4.0

The industrial revolution started with Industry 1.0 which dealt with the mechanization of machines through power generated by water and steam in the 1700s. Prior to this, production was centered at homes and individual workshops, called as the 'cottage industry' which was driven by waterwheel, windmills and horsepower. Rapid urbanization and territorial expansion created the pathway for Indistry 2.0 where electricity, assembly line and mass production were introduced. Automation took over in the 1900s and resulted in the third Industrial Revolution. The personal computer and internet made their debut during the Third Industrial Revolution.

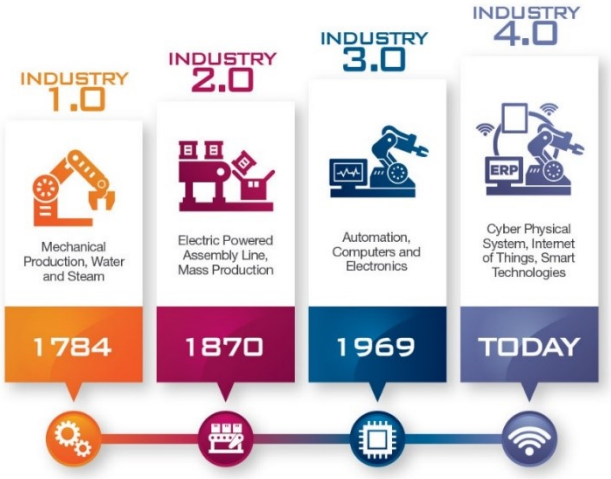


Figure 2: The Industrial Revolution

The Fourth Industrial Revolution began in Germany with the arising need of precison and accuracy in the products manufactured, increased quality, reduced downtime, fast and accurate decision making and custom made products. Its vision was to create **smart factories** built in with intelligent **Cyber Physical Systems**. What is a smart factory? What are Cyber Physical Systems? Along with these terms, many other terms mushroomed; internet of things (IOT), digital twin, augmented reality, horizontal, vertical and holistic integration, cyber security, cloud computing, big data, additive manufacturing and many more.

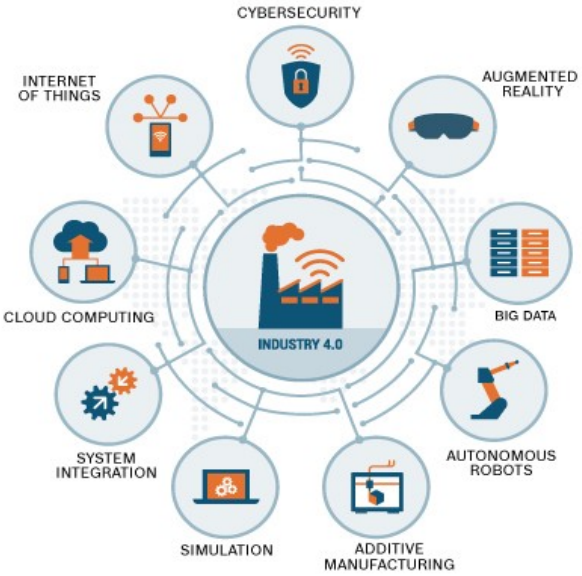


Figure 3: Industry 4.0 Components

To understand better the changes and the terms used, we will look into the traditional production; as a comparison with Industry 4.0 industries. In a traditional factory, there are many divisions and departments which runs individually. The departments directly related to the products are the research and development department, production, quality, maintenance, logistics and purchasing departments. The process is linear and sequential from one department to another and also from one station to another station in a production line. Manpower is needed to man the lines. The production operator adjusts the setting of the machine, feeds in the material and monitors the line whereas the quality operators inspect/test on the unfinished and finished products periodically. Tests include both destructive and non-destructive tests. For instance, if a test on a auomotive fuel hose in a automotive rubber hose factory failed, the immediate action would be sorting out the good hoses from the damaged hoses. This is done for the whole batch. Rework might be done on the damaged hoses if necessary. This process needs extra manpower and it costs time. Moreover, the production line might be stopped to rectify the problem. If the goods are mistakenly sent to the customers, it can cause customers' production line to be stopped. Therefore, to reduce or totally eliminate these problems, we need smart factories which can detect problems earlier and solve them without disrupting the production flow.

Smart factories are factories where the supply chain, the production, logistics and customers are all connected in a chain ecosystem which is known as the **digital supply network**. In a smart factory, real-time data is collected through sensors, actuators and RFID tags. This collection of data is called **Big Data**. You might be wondering what kind of data is collected. Data of temperature, vision, heat, dimensions, to name a few. In a smart factory, the data obtained are converted into useful information where action is taken immediately if there are any abnormalities found in the reading. The autonomous robots/ smart machines react to the problem by either solving the problem by itself or sending it to the control station where humans would solve the problems.

Having only raw data does not make any sense unless they are analysed and presented in a useful manner where it can be understood by the decision maker if in any case, a problem would occur. To make sense of this huge flow of data, **Big Data Analytics** and **Machine Learning** technologies are used. From these collection of data, mathematical models could be created to constantly improve precision, optimize the production line and forecast potential failures.

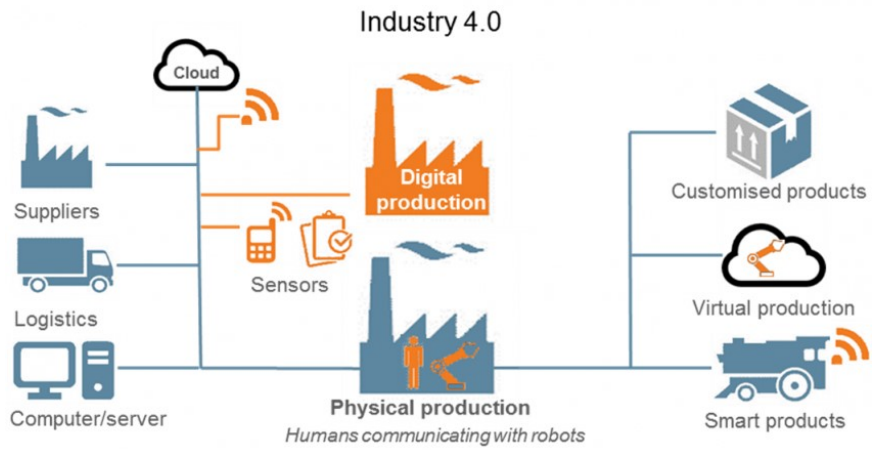


Figure 4: Smart Factory

The data from the '**smart objects**' (sensors, actuators, etc.) is collected and kept in the cloud where it is processed and combined with data from other devices ready to be retrieved by any personnel which needs the information. This is called as **Cloud Computing**. Having efficient data storage in the cloud is good but it makes data more exposed and retrievable by others which could actually create certain risks to any organization. How safe is the data kept in the clouds? To keep the data safe, another term emerged; **Cyber security.** Access to data by other parties could be controlled or restricted, passwords could be installed or malware could be detected. For all this to happen we need internet connection. Only with internet connection will sensors, actuators and RFID tags be able to input information for the machines or people to make decisions. This is the concept of **IOT (Internet of Things)** which builds intelligence into machineries and equipment and enable their status data to be transmitted.

When all the systems are integrated; the computing devices, smart objects, people and the physical environment tied by a communication infrastructure, it is called the **Cyber Physical System (CPS)**. Some other systems has emerged following the Industry 4.0 hype; House 4.0 (smart buildings and home), Power Grid 4.0 (smart grids), Health 4.0, Room 4.0, Education 4.0, Mobility 4.0 and Metering 4.0. For a **digital supply network** to work, **vertical, horizontal and end to end integration** need to be used. What are these? Vertical integration is the integration of cyber physical systems in the production line alone whereas horizontal integration is in between divisions and departments within the factory. End to end integration is through the entire value chain; the factory, logistics, supplier and customer. Integration means the information flow is no more sequential, every individual/ sectors gets information and reacts to the problems which arise or take precautions if there is any warning sign detected.

Figure 5: System Integration (Vertical and Horizontal)

Another technology advancement of IOT is the **Digital Twin**. Digital Twin uses **Augmented Reality** and **Data Visualization**. It can be defined as a precise visualization of a physical object that is used to visualize information in real time. Examples of Digital twin are; when a race car engine is visualized by a pit crew who uses the information to identify required maintenance such as component that is about to burn out or when the temperature and stresses on an aircraft engine' parts are viewed in flight or when a surgeon navigates a digital visualization of a heart before operating it. More time could be saved if this technology is implemented on the shopfloor. For instance, a maintenance personnel who needs to inspect on a breakdown machine, he can visualize the machine and its parts remotely and detect the problem instead of going under or into the machine. A design personnel can have a simulation done on an existing machine or new machine to check how efficient it will be.

Figure 6: Digital Twin and Augumented Reality

Well, the world have seen the importance and impact of Industry 4.0, and many changes are taking place in every sector; not only in factories but also in education, health and transportation, to name a few. To implement Industry 4.0 successfully in Malaysia, the future workforce needs to be equipped with all the necessary knowledge to accommodate Industry 4.0 requirements. Students need to understand on the systems practised in the production and use their knowledge of robotics and programming languages to be able to create and maintain a smart factory. The good news is, the Malaysian Education Ministry has already started creating a pathway for the implementation of Industry 4.0 in Malaysia.

Ms Shamini Patpanavan @ Pathmanathan

ALUMNI TRACKS

Lim Chee Chew – Electrical & Electronics Engineering 2009 - 2013

Being an outstanding alumni of APU (class of UC4F1310EEE), I am currently a visiting scholar with the State-Key Laboratory of Analog & Mixed Signal VLSI, University of Macau (UMAC), Macao, China and also a Ph.D. candidate from University of Malaya (UM) under joint supervision of Associate Professor Ir. Dr. Harikrishnan Ramiah (UM) and Assistant Professor Kevin Jun Yin (UMAC). My research interests include CMOS analog & RF integrated circuits & systems with specialization in RF oscillators, modelling and characterization of on-chip passive inductors / transformers.

Why did I choose to further your study?

Discovering new knowledge has been always interesting for me. I wanted to know more, I wanted to figure out things. Unlike from a conventional learning techniques in undergraduate, you gain knowledge through reading and critically analysing published scientific journals.

While pursuing my doctoral degree, I have been developing my transferable skills much more than I expected to do. I had the opportunity to attend workshops and trainings for this goal, but I have also had the opportunities to bring into practice what I've learned from these workshops - by presenting for various audiences, traveling to conferences and juggling several smaller projects at the same time.

Is the journey smooth or full with unexpected obstacles?

Ph.D. is no doubt "Permanent Head Damage". Even though the research area is my interest, things can go wrong most of the time. For example, the theoretical concept does not work well according to simulation, or especially when during chip test, the measurement result could not be accurately captured. Spending day and night trying to debug the problem is extremely stressful. With constant worrying, I almost suffer from depression and withdrew from social activities. I experienced health issues throughout my Ph.D. journey too. During peak time, due to long hours of working in front of PC, my left eye cornea had erosions and I had to bear the pain to finish it on time before I can go for surgery. However, by overcoming these obstacles, I truly believed that Ph.D. is not about discovering new knowledge, but also a test of perseverance.

Throughout my Ph.D. study, what is the biggest achievement so far?

Under the guidance from my supervisor from UM and UMAC, for the first time in the history of Malaysia, my research work "An *Inverse-Class-F CMOS VCO* with *Intrinsic-High-Q 1st-* and *2nd-Harmonic Resonances* for *1/f2*-to-*1/f3*. *Phase-Noise Suppression Achieving 196.2dBc/Hz FOM*" has been accepted for publication in the 65th IEEE International Solid-State-Circuits Conference (ISSCC). Organized by IEEE Solid-State Circuit Society, ISSCC is known as "chip Olympics", as it is the most prestigious and highest-level conference in the world in the field of solid-state circuits & electronics with an extremely rigorous paper selection process. Attended by more than 3000 chip designers around the world consisting of leading industries (TSMC, Qualcomm, Samsung, Broadcom etc.) and academia (UCLA, MIT, TU Delft etc.), ISSCC showcases annually the latest trends in global solid-state circuit research and development.
Getting a paper accepted in ISSCC and present my research work in front of thousands of top notch professors worth every single efforts I spent!

Advice to APU students?

Hard work/effort will never betray, it only pays. I can do it, why can't you?

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SEMINARS & WORKSHOPS

Journey to Become a Chartered Engineer – January 23, 2018
Mr Lim Yew Kee CEng, MIET

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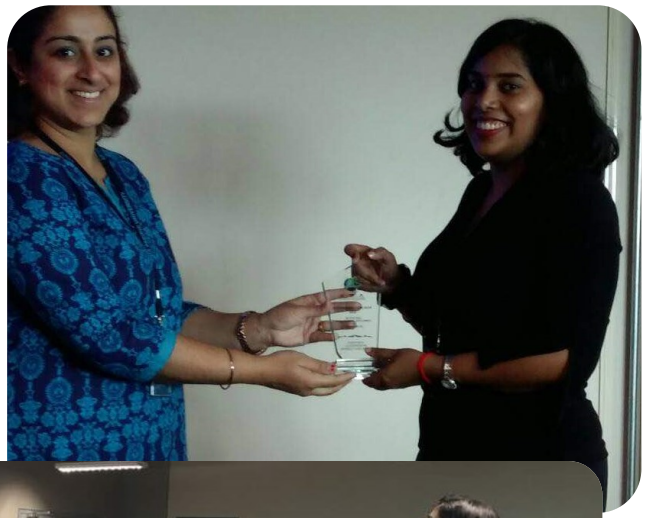
SEMINARS & WORKSHOPS

Drilling Engineering & supervision – January 29, 2018
Ms Devina A/P Amaleswaran, Petronas



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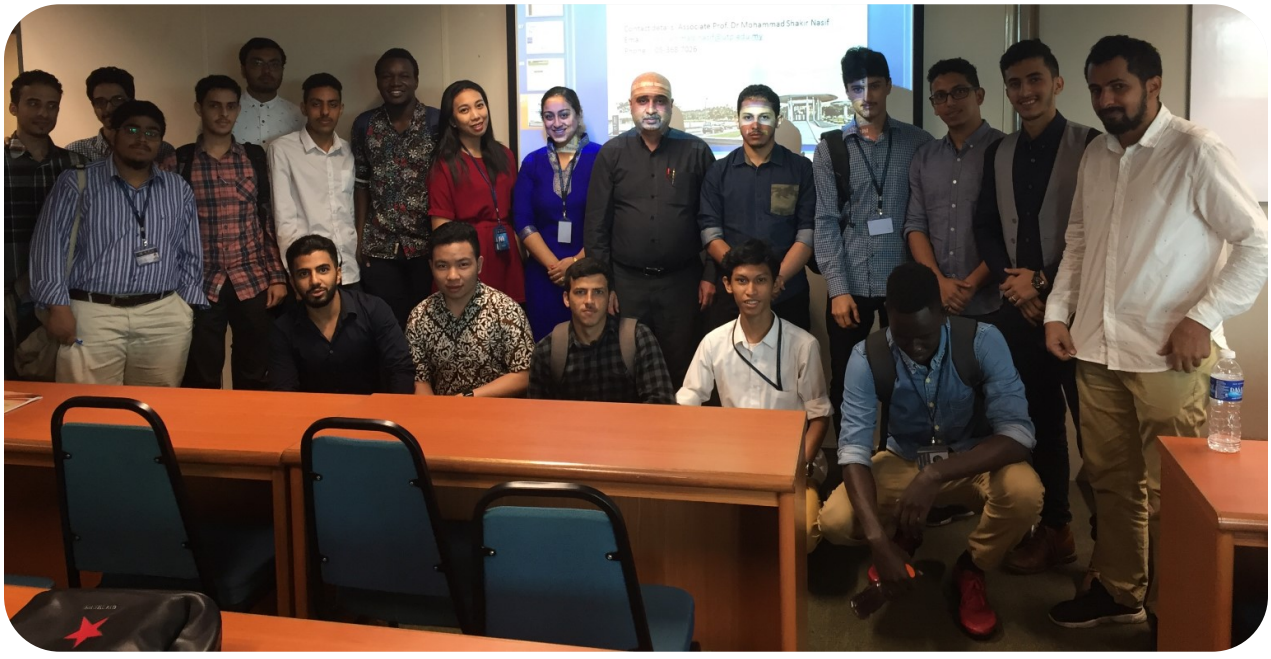
SEMINARS & WORKSHOPS

Big Data and the Energy Industry – March 12, 2018
Premkumar Chandra Shegaran, Co-Founder, Oxygen Technologies Sdn Bhd

SEMINARS & WORKSHOPS

Fire and Explosion Safety for Oil & Gas Industries – March 19, 2018
Assoc Prof Dr Mohammad Shakir Nasif, Universiti Teknologi Petronas



SEMINARS & WORKSHOPS

Building a Rapport and Communicating with Anyone in 30 Seconds
April 4, 2018
Mr Wesley Chan, Vision Alliance

Building Information Model (BIM) Implementation from 2D to 7D
April 5, 2018
Mr Muhammad Iyas Mahzan, Director, Unified Training & Management Resource Sdn Bhd

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Water Flooding for Oil Reservoirs - April 6, 2018
Assoc Prof Dr Syed Mohammad Mahmood, UTP

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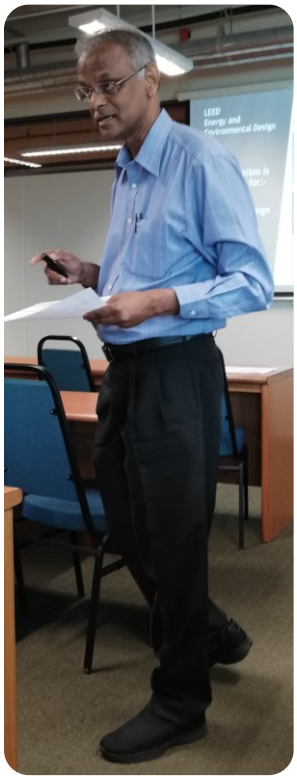
ELECTRONS RIDE THE WAVES - APRIL 11, 2018
PROF IR DR AHMAD FAIZAL MOHD ZAIN, ACADEMY OF SCIENCES, MALAYSIA

SEMINARS & WORKSHOPS

Understanding Single Line Diagrams and Getting Ready to be Employed in an Engineering Consultancy Organization - April 12, 2018

Ir Rajasegaran Thevaraj, Perunding Shanu Sdn Bhd, Mechanical & Electrical Consulting Engineers



PETROLEUM GEOSCIENCE 101 INDUSTRY'S PERSPECTIVE- APRIL 13, 2018
MR AZAD AZMAN, SENIOR RESERVOIR GEOLOGIST, PETRONAS

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SEMINARS & WORKSHOPS

Big Data Analytics for Beginners - April 19, 2018
Assoc Prof Dr Jafreezal B Jaafar, Universiti Teknologi Petronas

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SEMINARS & WORKSHOPS

SYSTEMATIC INNOVATION FOR INDUSTRY 4.0 WITH TRIZ - APRIL 24, 2018
DR. ZULHASNI ABDUL RAHIM, FOUNDER OF TRIZ CENTRE OF EXCELLENCE, NATIONAL TRIZ INNOVATION EXPERT

SEMINARS & WORKSHOPS

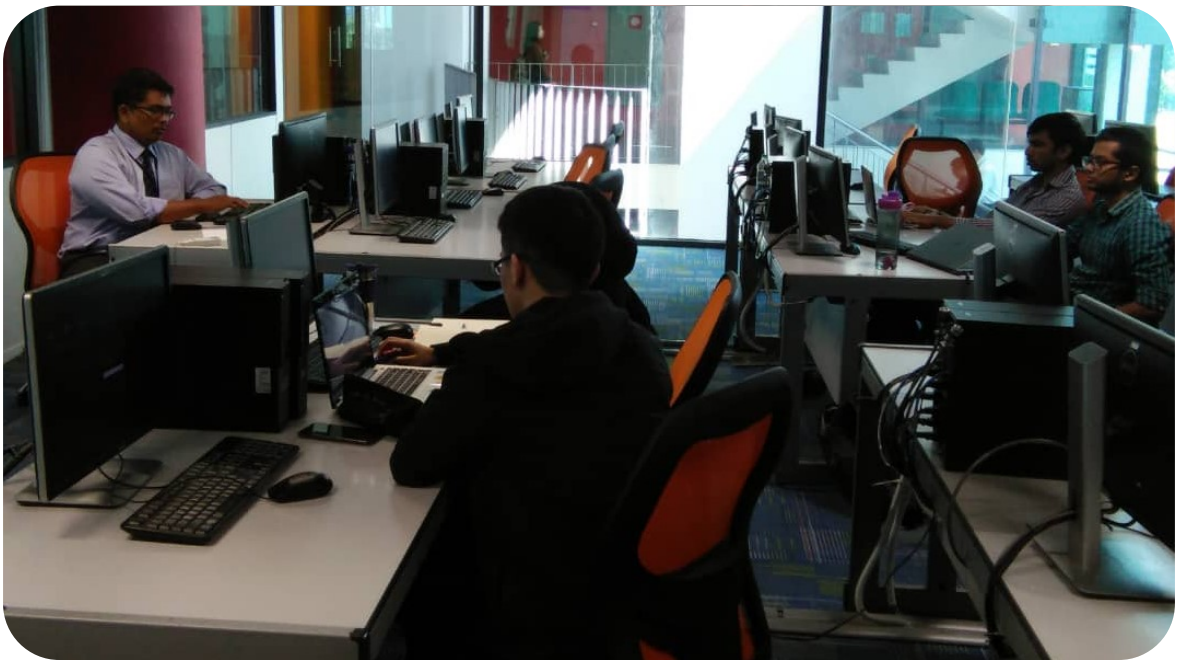
Engineering Education for Sustainable Development - May 4, 2018
Dr Subarna A/P Sivapalan, Universiti Teknologi Petronas

Matlab/Simulink for Power System Analysis – June 8, 2018
Mr Ravi Lakshmanan, APU

SEMINARS & WORKSHOPS

Digital Era Benefits of Big Data & Cloud Computing – June 26, 2018
Dr Sankaraiah Sreeramula, Ace Resource Advisory Services Sdn Bhd

Introduction to Cisco Packet Tracer - June 28, 2018
Mr Yogeswaran Nathan & Dr Kamalakannan Machap, APU



SEMINARS & WORKSHOPS

AoC on LT Spice & Breadboard – June 30, 2018
Dr Lau Chee Yong, APU

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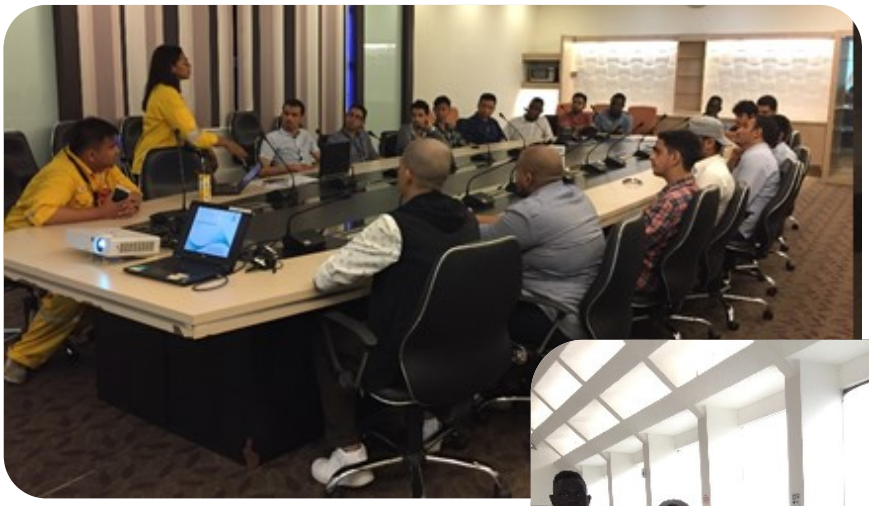
INDUSTRIAL VISITS

Petronas Penapisan, Melaka – January 10, 2018



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INDUSTRIAL VISITS

Smart City Talk – February 27, 2018

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INDUSTRIAL VISITS

Mutiara Synergy Solution Sdn Bhd – February 28, 2018

Schlumberger (M) Sdn Bhd – March 6, 2018

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ABB Malaysia Sdn Bhd – March 20, 2018

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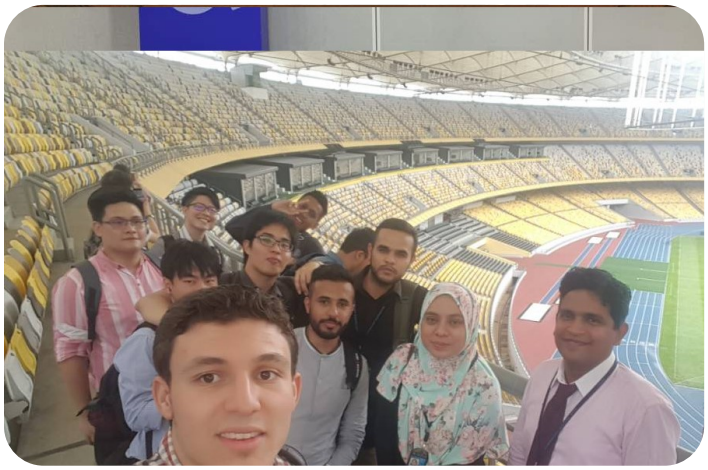
KL Sport City – March 26, 2018



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INDUSTRIAL VISITS

CIDB Construction Career Fair – March 27, 2018

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INDUSTRIAL VISITS

Telecom Malaysia– March 28, 2018

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Visit to German Malaysian Institute – April 7, 2018

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Measat Satellite Sdn Bhd– April 19, 2018

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Measat Satellite Sdn Bhd– April 19, 2018

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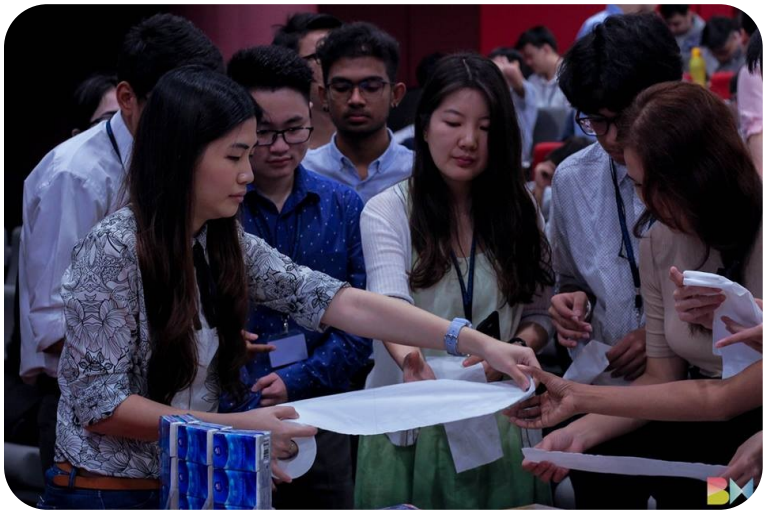
INDUSTRIAL VISITS

MetalTech – May 23, 2018

INDUSTRIAL VISITS

IEM-APU Student Section Career Talks



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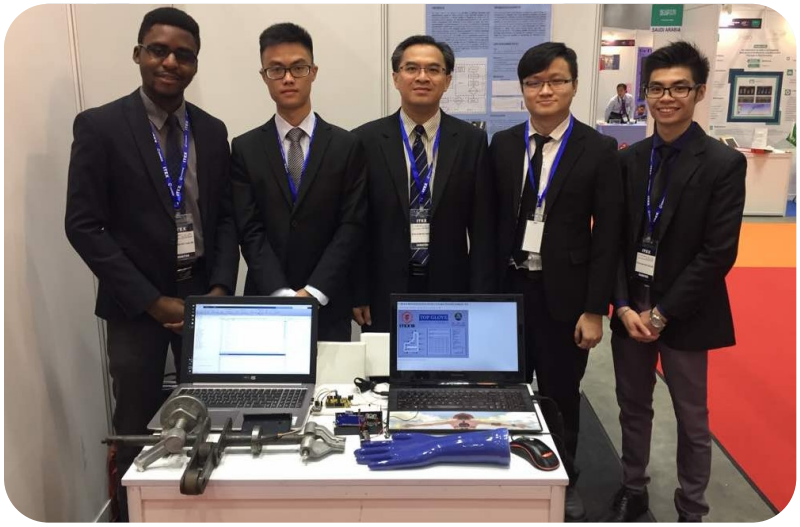
SOE COMPETITIONS

ITEX 2018



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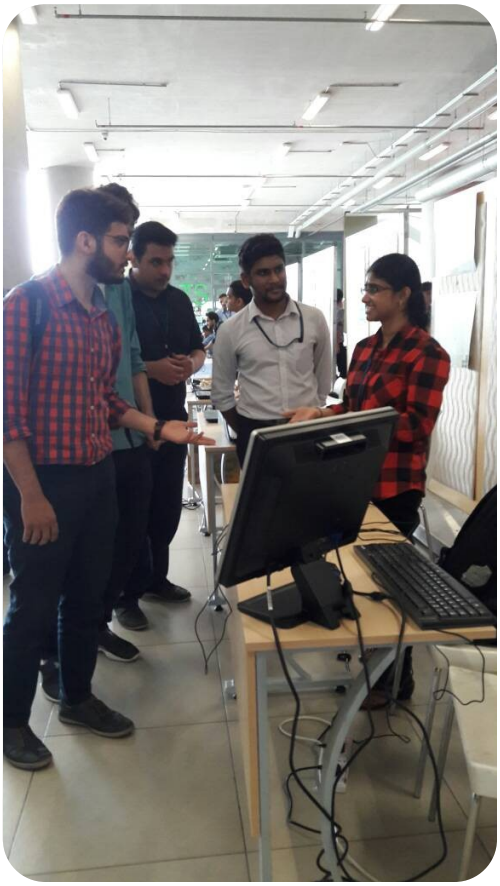
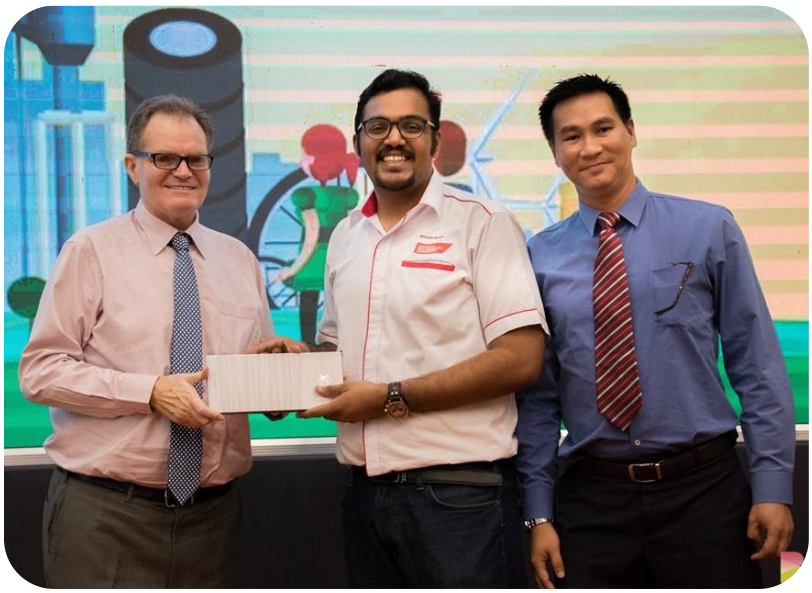
SOE FINAL YEAR PROJECTS

Poster Presentation UC4F1707ME-TE-EEIT-EEE



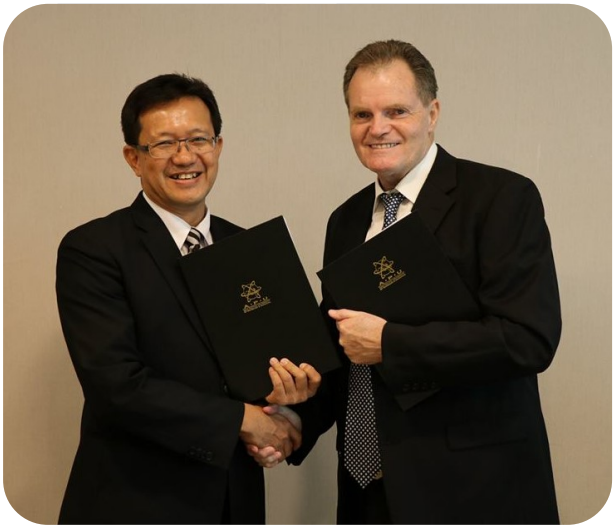
SOE EVENTS

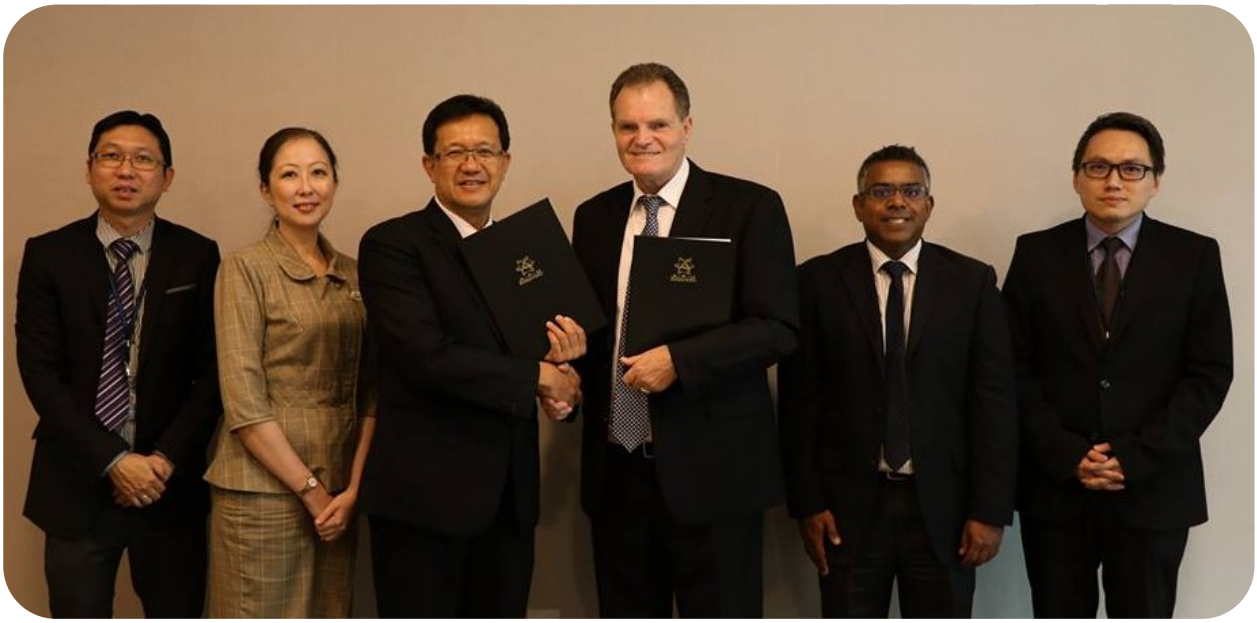
IMechE – APU Student Chapter Inauguration



SOE EVENTS

APU – IMM MoA Signing Ceremony





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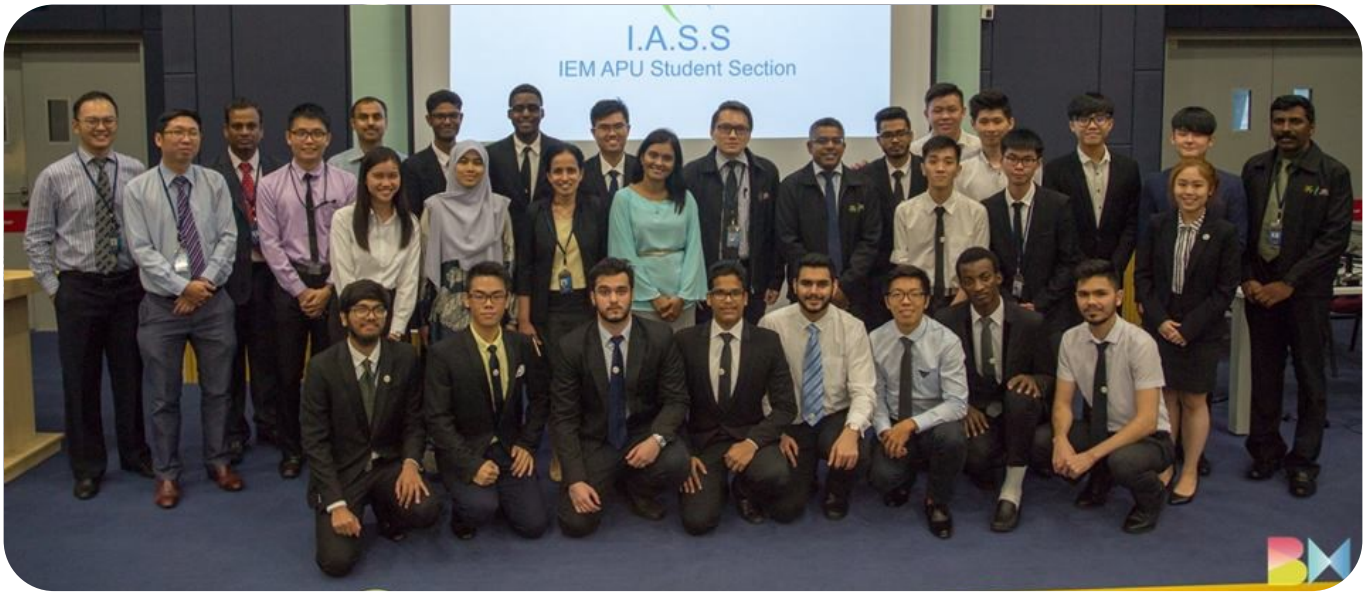
SOE EVENTS

IEM – APU Student Section Handover Ceremony

IEM-APU Student Section Office Bearers - 2018



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SOE EVENTS

MATLAB 2018A LAUNCH

IEM GOLD AWARD 2018

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SOE EVENTS

ENGINEERS DAY – MARCH 14, 2018

Cultural Diversity is the greatest strength of Humanity